solplan review

the independent newsletter of energy efficient building practice

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INSIDE....

Indoor air quality has become a major concern for today's homeowners. Radon gas is one contaminant that has received considerable attention recently. In this issue we look at what radon is and discuss how serious it is. Safe levels of radon are reviewed, and show where radon is found in Canada. Fortunately, it is relatively easy to deal with radon inside the house, so we don't just raise the issue, but describe some methods by which radon can be dealt with if you are in an area likely to have higher concentrations.

Ventilation is recognized as being an inportant consideration. Mechanical ventilation requirements will now be a part of the building code; they already form a vital part of R-2000 program criteria. But just what are safe and acceptable ventilation levels? We review these issues.

A recent study in Sweden compared the performance of ceiling radiant heating to wall mounted radiators, and found that ceiling heating was more efficient. We review this study and some control considerations for radiant systems.

Performance monitoring is of interest to builders. We review a number of items being looked at in several case studies currently being monitored.

Marketing ideas are always useful. We present the text of a warranty guaranteeing the energy performance of a low energy house that has proven to be a useful sales tool.

Other items include a review of a book on low energy building in Sweden; letters from our readers; information on a new super window industry group; new HRV products; and LEBCO commentary and news.

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THE RADON ISSUE

FROM THE PUBLISHER

Your mother used to tell you, quite reliably, what was bad for you. These days, the industrial use of the scientific method yeilds incredibly accurate measurements of subtle environmental factors. And your mother can't say what effect these chemicals, emissions, and syndromes will have on you.

Radon is one of those factors.

One of the great jokes of the energy conservation versus nuclear debate occured when the nuclear industry pointed out that occupants of air-tight houses could experience greater exposure to radioactivity from soil emissions than from fission power plants. It turns out that for some locations this is probably not a joke.

Radon's effects are so long term that it is impractical to blame radon emissions as a cause of death. Cause and effect don't link well over several decades. We know that over certain limits radiation isn't good for you. Below those limits, it is not clear whether radiation is deadly or merely inconvenient. Such exposure varies widely across Canada. It is clear that there are simple measures to resolve exposure to radon. In this Solplan Review we outline the issues and suggest solutions.

Richard Kadulski
Publisher

SUPER WINDOW GROUP

SUPER WINDOW INDUSTRY COMMITTEE

A new group with the objective of promoting the development of super window technology in Canada has been formed.

The group's task is to ensure that the potential of emerging super window technology is not overlooked in the developments of Federal Policy. At the present, there are two policy issues that are going to be addressed: the need for increased cost-shared R&D funding for super window technology, and obtaining a long term committment from the government supporting the commercialization of advanced building technology.

Is this just another self-serving group out to get more contract money for themselves? A cynic could say yes. However, super-window technology is the area where the next major breakthrough is going to take place. Theoreticaly, windows with R values of 8-12 are possible but more development is required to see these on the market.

If we are going to wait until the industry does the work on its own, we will, in typical Canadian fashion import the technology from someone else, and pay the royalties, instead of receiving them ourselves. The Canadian industry is too small, fragmented, and undercapitalized to undertake the necessary research entirely on their own.

Other countries, notably Japan and Sweden have not dismantled their well funded research programs because of a temporary reduction in world energy prices.

For more information, contact the Super Window Industry Committee, Conservation & Renewable Energy Industry Council, 206 - 135 York St., Ottawa, Ont. K1N 5T4 (phone: 613-236-5053).

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THE RADON ISSUE

There has been concern expressed about radon in housing. Much of this has originated in the USA. But is it a problem in Canada? Is the general concern about radon an overreaction to isolated incidents?

Radon is one of those naturally occuring environmental contaminants that are present everywhere. A recognition of the problem, and good building practice can minimize any adverse effects.

WHAT IS RADON?

Radon is a colourless and odourless radioactive gas formed by the natural decay of radium. It is present in soil, rock and ground water in varying concentrations in all areas of Canada.

Radium is present in all stone material, but mostly in alum shale and certain granites, as well as some clay soils, usually in trace amounts. Uranium and phosphate deposits have high concentrations, granite and shale somewhat lesser amounts. As the amount of radon is related to the subsoil conditions, levels can vary widely from region to region, and even within a neighbourhood.

Since radium is found naturally in many soils, it is almost impossible to avoid it. Depending on the local geology, high concentrations of radon can build up in poorly ventilated spaces.

Radon gas enters buildings from the soils on which they are constructed by way of cracks and other openings in the foundation. In some cases, radon can also be introduced by the water supply, especially when the water source is a well. Small quantities can be released by building materials such as stone, brick, concrete and plaster.

As radon is heavier than air and normally enters buildings from the surrouding soil, concentration of the gas is usually highest in the basement.

HOW SERIOUS IS RADON?

As with other radioactive materials, 'acceptable' levels of the materials have been established, but the full implications of exposure are not known with any certainty. Naturally occuring background levels of radon in the open air are low, and a poor indicator of potentially harmfull levels inside a building, where in some situations, a high concentration can build up.

The major concern about the health effects of exposure to radon is not the radon gas itself, as it has low radioactive emissions. However, when radon breaks down, it decays into solid radon 'daughters' which decay rapidly and give off significant radioactivity in their short life.

The radon daughters attach themselves to any particles in the air, such as dust and smoke, or any other solid items they come in contact with. The radiation emmitted is capable, in the long run (20-40 years), of causing lung cancer. The risk is determined by the concentration of the radioactive radon daughters.

Conclusive correlation of exposure to radon at low concentrations and cancer formation has not yet been determined. Most research work in this field has been concerned with occupational conditions in mining operations, where hard work and dust is present in high levels, where silicosis is a bigger concern, and where radon concentrations are much higher than are likely to be encountered in a home.

Discussions of safe levels are clouded by the safety of smoking issue. The highest radon levels generally encountered have been equated to the impact of cigarette smoking. As long as people smoke, it is difficult to isolate the consequences of smoking from radon exposure.

One statistical analysis in a northern US state couldn't isolate lung cancer rates that may be caused by radon because all cases could be attributed to smokers. However, it should be kept in mind that smoke contains particles, which will act as magnets (and carriers) for radon daughter particles. If radon daughters are present, they will attach themselves to the smoke particles and can be inhaled. This will increase the lung cancer risk of the person inhaling the smoke (whether or not he is a smoker).

WHAT ARE SAFE RADON LEVELS?

Radon gas concentrations are relatively easy to measure. However, there does not seem to be any agreement about what

constitutes safe levels of radon. There are no definitive standards in Canada.

Ontario guidelines suggest 5 pCi/l (pico-curies per litre) are acceptable levels for radon. The US Environmental Protection Agency says the safe threshold is 4 pCi/l; ASHRAE (American Society of Heating, Refrigerating, and Air Conditioning Engineers) uses a figure of 2 pCi/l.

The Ontario guidelines were derived for Elliot Lake, where remedial action was taken in houses with greater concentrations.

Radon daughter concentrations are measured in terms of 'working levels'(WL). A 'working level' is a unit of measurement which relates radon concentrations to radon daughter levels. The relationship between WL and picoCuries is WL=FxC/100 where F is a factor that defines the proportion of radon daughters to radon gas concentration. The relationship is not a direct linear relationship. It is affected by air circulation, ventilation rate, and filtration system.

What are safe levels for radon daughters? According to ASHRAE the acceptable level for radon daughters is 0.01 WL (working level). Sweden sets a maximum limit of 0.02WL. An unpublished draft report by the federal government suggests that a level of 0.02WL is acceptable, but if measured levels are above 0.01WL, detailed investigations are warranted. A Canadian Environmental and Occupational Health Advisory Committee (federal/provincial) is in the process of determining a satisfactory level for homes. Its interim guideline is 0.1WL.

Numbers can be manipulated in many different ways. Given the variation of 'acceptable levels', we wonder who is playing the game and why? It almost appears that the Occupational Advisory Committee is suggesting that we can eliminate most problems by raising the acceptable limits to a point at which most of not all observed measurements are safe, regardless of true safe levels!

A favourite trick is to refer to the 'mean' levels - these average the high and low levels, so that the overall average looks good (and safe).

The real concern is not to find the mean, but to determine the absolute number of houses where the observed measurements are high (or likely to be so). This would give us an indication of how big the problem is. Fortunately, it appears that this number is quite small, and remedial action can be taken easily.

WHERE IS RADON FOUND IN CANADA?

Higher levels of radon are often found in areas where mine tailings have been used as fill, or if they were built in areas close to uranium mines.

The Department of National Health and Welfare conducted a survey (1977-78) of houses across the country. 10,000 homes were chosen at random in 14 cities to determine the background concentrations of radon and radon daughters. Table 1 shows the number of houses with radon and radon daughter concentrations at or above the accepted levels.

TABLE 1 Measured Radon Concentrations

LOCATION	RADON MEASUREMENTS pCi/l		RADON DAUGHTER (WL)	
	% HOMES OVER 2.0 pCi/l	% HOMES OVER 4.0 pCi/l	% HOMES OVER 0.01 WL	% HOMES OVER 0.02 WL
VANCOUVER	0.2	0.0	1.2	0.0
CALGARY	7.6	1.7	9.8	0.8
THUNDER BAY	16.6	5.3	22.1	3.3
SUDBURY	16.8	4.9	35.6	11.3
TORONTO	2.4	0.1	13.6	1.7
MONTREAL	5.3	1.5	9.7	2.2
SHERBROOKE	16.4	8.0	21.8	8.3
QUEBEC CITY	7.2	3.3	10.1	3.1
FREDERICTON	21.5	6.8	34.7	6.6
SAINT JOHN NB	13.6	6.2	18.	4.2
CHARLOTTETOWN	14.6	5.1	12.5	1.2
HALIFAX	-	-	31.4	9.3
ST LAWRENCE NFLD	27.7	15.7	19.3	6.
SAINT JOHN'S NFLD	10.2	3.8	11.8	2.1

The survey found that most homes had very low levels of radon and radon daughters. However, in a small but significant minority of houses in some cities higher concentrations were observed. Statisticaly significant geographical differences were observed. However, variations within each city were generally larger than between the cities. Unvented basements generally accounted for the highest concentrations.

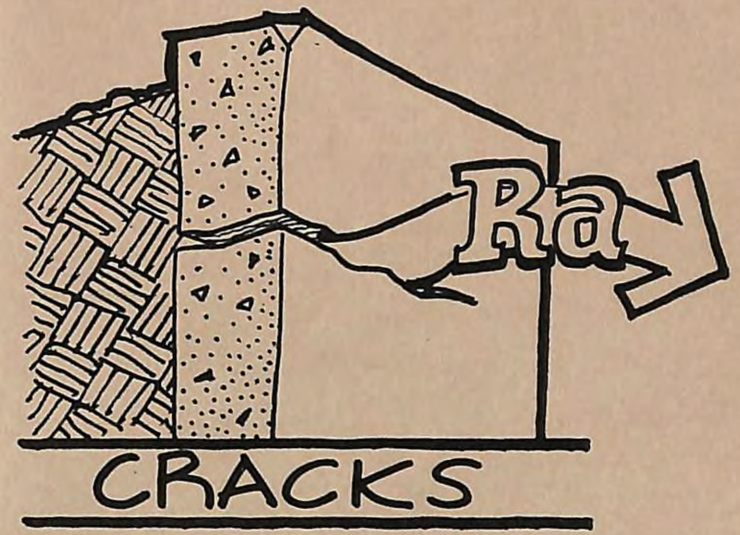
There are several regions in the country that were not included in that study. It appears that many parts of the prairie provinces, with their clay soils, have high radium concentrations. A separate study has shown that 15.9% of surveyed homes in Winnipeg had concentrations above the levels at which remedial action was done in Elliot Lake. Other prairie cities surveyed (and the number of houses with higher concentrations) included Regina (9.6%), Brandon (5.3%), Saskatoon (3.8%).

HOW DOES ONE DEAL WITH RADON?

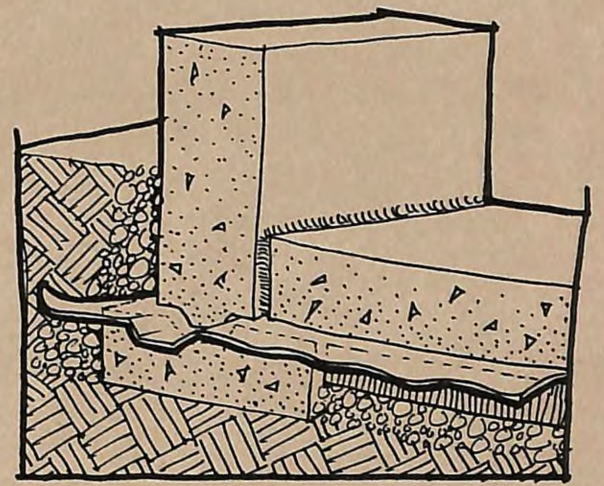
Fortunately, it is relatively easy deal with radon inside a house. The main defense is to cut off the radon entering into the house, and to dilute and filter the gas that is present in the house.

As radon gas is heavier than air, it tends to concentrate in the basement. Radon gas entry can be cut off by sealing up all openings and cracks in the basement, and observing good air sealing and water proofing practices by means of a continuous air barrier.

Radon gas can be stopped by ensuring



there is a continuous membrane under the floor slab (such as 6 mil or heavier poly), and extended past the wall-slab joint.



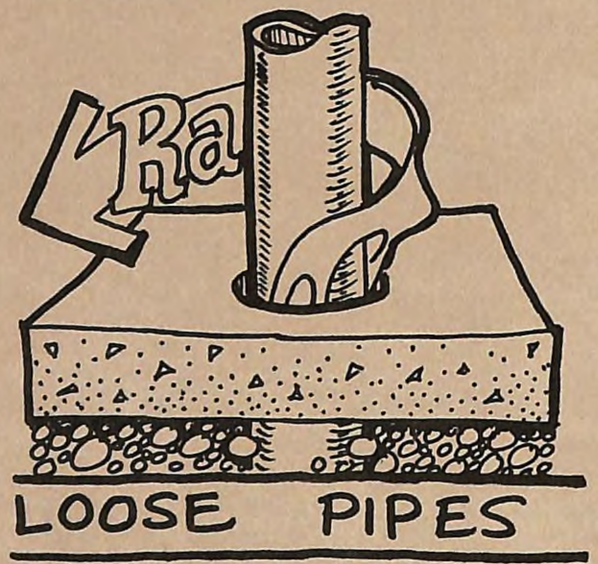
A waterstop joint can be used at the wall-slab joint.

Any service penetrations through the foundation wall should be sealed with a good quality flexible masonry caulking.

Floor drains should be fitted with a backflow prevention damper in the drain, or at least tight fitting cover, especially in an existing house with a floor drain that has no trap in it. If a cover is not appropriate, and the drain (with a trap) is seldom used, a light oil film on the water will minimize evaporation of the water in the drain trap.

Open sumps inside the basement should be avoided if at all possible. If one is absolutely needed inside the basement, it should be fitted with a tight cover.

Within the house, radon concentrations



will be reduced by air circulation. Air circulation in the basement in important, for it will move the radon through the house. While this may appear to increase radon levels in the main living areas of the house, it will also reduce radon concentrations in any one area. The forced air movement will bring air that contains radon daughters into contact with many surfaces (ducts, walls, furnishings) so that any radon daughters will tend to adhere to these surfaces and will not be available for inhaling.

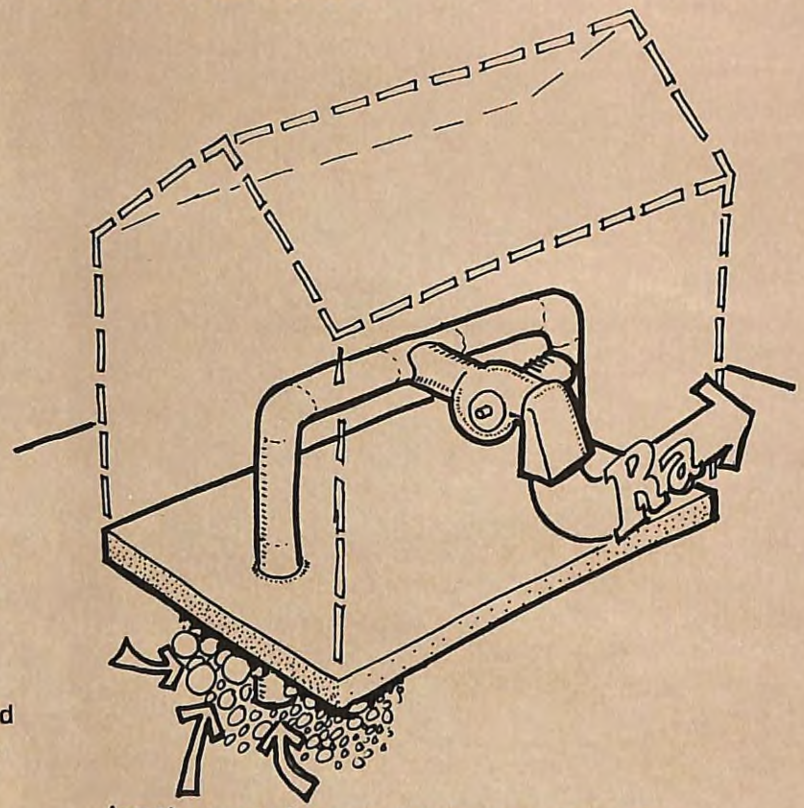
In a forced air heating system, continuous low speed air flow is important to dilute radon concentration.

Radiant heating systems do not offer the same ease for reducing radon concentrations. In such cases, especially in houses where the basement is not used as living space, a separate air circulation loop should be considered.

It is important to note that mechanical ventilation systems must be designed and installed carefuly to ensure that the basement areas are not depresurized, or this will only draw more radon into the house. It is for this reason that we are concerned about some of the new integrated heating systems that rely on a negative pressure through the building envelope.

Unheated, vented crawl spaces (with an insulated floor above) would be the prefered option to use in areas where radon is a serious concern. This is a good reason why basements should be avoided in radon rich areas.

In some radium rich areas, aggregate used in the concrete can give off significant levels of radon. In such areas, preserved wood foundations would be a good alternative.



Another option would be to vent the subsurface soil. This can be relatively easy if the floor is known to have a gravel base, or if the soil if porous. A solid pipe (a 4" diameter PVC pipe should be enough) can be put into the ground below the basement floor, and power vented to the outside by a small fan.

Another variation consists of a dry well dug to a depth of 4 metres at a distance of 10-60 metres from the house. A powerful fan located inside the well extracts the radon and blows it out into the open. No pipes or ducts into the house are needed. It is estimated that a well of this kind can reduce radon content to acceptable levels in all houses located within 10,000 m^2.

A recent Swedish experimental installation (autumn 1983 to spring 1984) showed radon levels inside a test house reduced by 96%. The cost of such an installation is estimated at $1600 US, and can serve several houses.

Obviously, this kind of solution can only be used in gravel ridges and other highly permeable soils. Geologists and ventilation specialists should be involved in the design of this kind of project.

If several units are to take advantage of this type of system (to share the expense), it seems that it would be more suitable for townhouse type developments rather than individual single houses (or else who is going to pay for and maintain the equipment?).

HRV UPDATE

NEW FROM CES: vanEE 2000 Plus

Conservation Energy Systems, manufacturers of the vanEE HRV have a new model: the 2000 Plus. This unit has a modified core which improves the efficiency to 70% in ORF tests at 0°C. Cold weather test data was not available at time of publication.

This unit improves the performance of the vanEE, and will be of special interest in the milder areas of the country, especially where average monthly temperatures are 0°C or better.

NEW FROM NOTRON INDUSTRIES

AIR CHANGER DRA 275

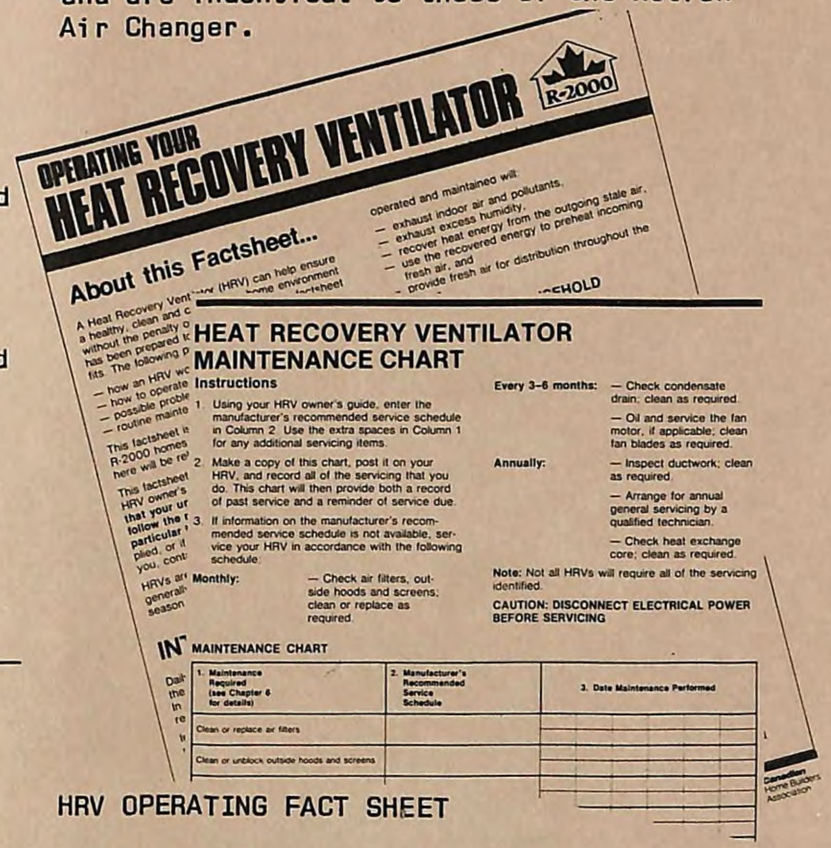
This is an improved version of the DR-275 unit, which is self balancing at low speed. The manufacturer claims this modification results in a significant enhancement of the unit's cold weather performance.

AIR CHANGER DRA 150

ORF test data (not officially released at time of publication) indicate this small unit has an efficiency rating of 76% at the 0°C test. Gross air flow supply at 50 Pa is 163 cfm (81 cfm at 100 Pa).

LENNOX HRV's

Lennox Industries (Canada) Ltd. is now marketing HRV's under their name plate. The units are manufactured by Airchanger, and are indentical to those of the Notron Air Changer.



HRV OPERATING FACT SHEET

The R-2000 program has prepared a fact sheet titled 'OPERATING YOUR HEAT RECOVERY VENTILATOR'.

This fact sheet has been written for the layperson, intended to be a supplement to the HRV owner's manual. In crisp, concise language, and a clean graphic package it introduces the reason why ventilation is required, explains the parts of a typical HRV, and explains how to operate an HRV.

An HRV trouble shooting guide lists 8 common problems, and suggests action an owner can take for them. Routine preventive maintenance is outlined, and and a maintenance chart is provided (this also acts as a checklist for action to take).

This is an excellent brochure that every low energy house purchaser should receive. Even if the homeowner doesn't read the owner manual supplied by the manufacturer (how many people actualy read an owners manual?), this fact sheet will probably be skimmed through quickly.

Copies are available from the R-2000 regional offices.

CEILING HEATING

What is the best, most efficient form of heating - in terms of comfort and energy conservation?

While human comfort is a subjective matter, difficult to generalize, energy performance can be measured. A recent study in Sweden compared the performance of ceiling radiant heating to wall-mounted radiators.

It was found that radiant heat, in the form of ceiling radiant panels, can provide a more even indoor climate at a lower energy consumption, than conventional wall mounted radiators.

This may seem to be contradiction of normal law of physics. After all, it is commonly known that heat rises, isn't it? While hot air rises, heat flows from hot to cold in any direction. This principle is the difference between systems that heat the air to heat the house and radiant heating systems that directly heat surfaces and objects.

Radiant ceilings operate on the principle of warming the ceiling material, converting the surface into a radiator. By making the ceiling temperature higher than other surfaces in the room, energy is radiated from the ceiling to the cooler surfaces, and thus warming them.

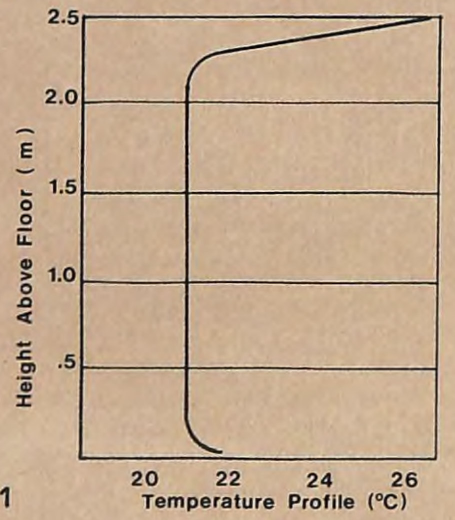


Figure 1

The reason that radiant heat is more efficient than convected heat (as from the "radiator" or a hot air system) is that it provides: more even temperature distribution (see fig. 1); a lower air temperature for the same operating temperature; higher surface temperatures (mainly floor temperatures), which means that the air temperature can be kept lower with ceiling radiant; a faster response time to controls.

However, the quality of thermostat controls is very important. Most thermostats measure ambient air temperatures. These cycle the heating system in response to changes in room air temperature.

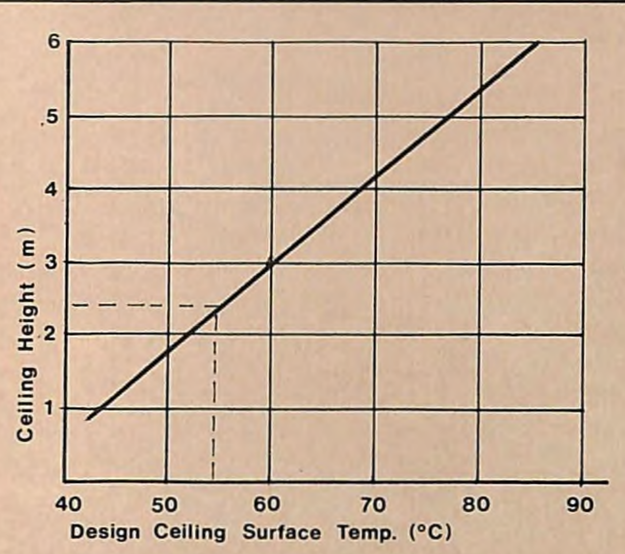
Controls are designed mainly for hot air heating systems (the most common systems in use). But in radiant heating systems, air temperatures can be kept cooler. If the homeowner is not familiar with this, he will tend to keep the thermostat at a higher setting than is required for comfort - after all, he knows that 68-72°F is a comfortable range. He may be hesitant to leave the thermostat at 65°F (or whatever the lower setting may be for adequate comfort). At a higher setting, he will be paying for more heat than is needed.

Homeowners must be made aware that they should keep thermostat settings lower. For this reason, we would like to see more use of thermostats labelled simply, without a thermometer or temperature markings.

SIZING A RADIANT HEATING SYSTEM

As with any heating system, the output should be designed to replace the heat loss from the room at design conditions, plus an allowance for pickup from a setback temperature. For low energy houses, the system should have an extra capacity of 10-20%.

The maximum operating temperature of a ceiling can vary with ceiling height



(fig. 2). For a normal 2.4m ceiling (8 ft), the temperature should not exceed 54°C. Higher temperatures could cause discomfort to the occupants. Occasionaly higher temperatures may be called for to offset the effects of higher heat losses from large windows or skylights.

VENTILATION: HOW MUCH IS ENOUGH?

Are we cooling our homes by the mechanical ventilation systems we are putting into them? Do current ventilation standards call for more fresh air than is needed?

Ventilation criteria are developed to ensure that indoor air quality is maintained for a safe and healthy indoor environment. Uncontrolled air leakage has traditionally been relied on to dilute contaminants generated in houses (carbon dioxide generated by occupants, moisture generation, off-gassing from furnishings, etc). But how much ventilation is adequate?

The minimum outdoor air supply needed to dilute the carbon dioxide produced by a person seated at rest is 1.5 L/s. ASHRAE suggests that 2.5 L/s (5 cfm) per person is the minimum fresh air needed. This number contains a reasonable safety factor.

Stress is placed on ventilation because of the recognition that tight houses have reduced natural air leakage into the house. Since standards are established without knowledge of any specific location or occupancy pattern, they will generally add safety factors to the minimums to cover all possible conditions. Thus, a recommended ventilation rate for residences is 3.5-5 L/s per room, plus an installed capacity of 15-25 L/s (30-50 cfm) for intermittent use. These levels would provide adequate fresh air supply for a healthy environment in most situations.

However, the latest ASHRAE recommendations have been increased. This latest standard is what is being proposed in the new R-2000 technical criteria.

Our suggestion is that the minimum continuous supply required is too high.

Let's consider a typical 3 bedroom, 2 bathroom bungalow with basement. According to the proposed R-2000 standards, the house may require 120 cfm of continuous ventilation (plus an additional capacity). However, this house will probably be occupied by no more than 4-5 people. As we've seen, the minimum fresh air needed (for health safety) would be 20-25 cfm. If we allow a 100% margin of safety, 50 cfm would suffice most of the time.

The peak system capacity should still be sufficiently high to provide for those times when greater ventilation is needed. But what the peak capacity should be is another issue. The ASHRAE (and R-2000) criteria seem to be somewhat arbitrary, and excessive.

While we suggest that the minimum continuous ventilation rate should be lowered, a good system will still be operated at what the occupants of the house find comfortable. If the minimum does not provide enough fresh air, the occupants can fine tune the ventilation system to what is comfortable.

Should we be concerned about the higher continuous ventilation levels? If adequate fresh air can be supplied at a lower ventilation rate, the excess ventilation only cools the house. Even the best heat recovery ventilator can't provide more than about 80% heat recovery (and most much less), so some heat is always lost, and the incoming air is always cooler.

Monitoring of house air change rates to measure the actual ventilation rates in R-2000 houses compared to conventional houses (which relied solely on natural air leakage or infiltration) indicates that the average air change rate for all R-2000 houses was 0.37, while it was 0.34 for the control houses.

At first glance, this may seem to imply that R-2000 houses are leakier than control houses. However, the monitoring results take into account the mechanical ventilation equipment capacity and the type of air distribution system used.

This indicates that low energy houses, meeting R-2000 standards are NOT the airtight, stuffy, unhealthy boxes some people think of. In fact, a legitimate concern can be made that R-2000 houses may be too leaky! Perhaps the stress should be on total system capacity, with a lower continous ventilation rate. After all, if 5 cfm per person is adequate, why not?

We suspect that one technical problem for HRV manufacturer's is getting a satisfactory motor that can move less air at its low speed. But if there is a need, someone will always develop one. An incentive to the industry will be an agreement on acceptable ventilation requirements.

LETTERS TO THE EDITOR

Sir,

Re: How Much Does Energy Cost. You may have used EMR to source your cost data for Alberta. However, unfortunately, utility rates are not as straight forward as they should be. Taxes, rebates and fixed charges abound and the way these charges are computed is shrouded in mystery. However, unravelling same is of interest.

Your costs for Alberta are too high by a long shot - at least for the city of Red Deer, which charges (as of April 4, 1986) as follows:

Natural gas: $2.4512/GJ plus $8.30 per month fixed charge

Electricity: $0.03776/Kwh plus $10.65 per month fixed charge

The electricity rate is my calculation, of an elaborate rate structure. It is in fact the equivalent of the charges.

Regards,

Jim Marke
Red Deer, Alta.

This underlines the convoluted way by which energy is priced. We will try to find out how EMR establishes their average data.

Our intention was to give an indication of what energy prices were in various parts of the country, and how much variation exists in pricing policy.

Sir,

Your article (How Much Does Energy Cost) in the Feb-Mar. 1986 issue is inaccurate and in some respects misleading.

I assume the electricity cost in B.C. refers to purchases from B.C. Hydro. Although there are different rates charged by West Kootenay Power & Light and various municipal utilities, the B.C. Hydro residential rate is:

Basic charge of $6.52 for 2 months
First 550 Kwh @ $0.0642 (2 month period)
Additional kWh @ $0.0447

This rate has been applicable since June 13, 1985 and is 3.75% higher than 1984 (not 9.3% as stated).

In 1985 the average cost of one Kwh of residential electricity was $.055 and not $0.0582 as stated.

However, the average cost per kwh in an electrically heated house is lower since the useage is greater and more falls at the final step of the rate. Further, if we are assesing whether to heat with electricity or not, we must realize that the first blocks of power at the higher step will be used by lights and applicance. Therefore, it is more accurate to calculate electric heating energy cost at the final step rate, which is $0.0447 per kwh.

Furthermore, you chose not to include meter charges in the costs for natural gas heating. The effect of the basic charge and higher first step of the B.C. Hydro rate are $8.62 per month, comparable to some gas meter charges.

Dave Read,
Cranbrook, B.C.

Sir,

In the Feb.-Mar. 1986 issue of SOLPLAN REVIEW there are two tables that contain some inaccurate information on energy rates and costs in British Columbia.

The electricity rates you quote are based on a consumption of 1000 kWh per billing period (2 months). At B.C. Hydro rates, the first 550 kWh are at $0.0642/kWh, the remaining 450 kWh would be at $0.0447/kWh. The average cost therefore is $0.0554/kWh.

In the average home, the first 500 kWh are consumed by lighting and appliances. Therefore, electric space and water heating are done with electricity at the trailing rate of $0.0447/kWh. When converted into heat, the cost to the homeowner is $12.41/GJ.

Oil at $0.376/litre ($9.64/GJ) and 70% efficiency costs $13.77/GJ, or about 11% more than electricity.

If oil at $0.376/litre is to compete with electricity, it must be burned in equipment having a seasonal efficiency of at least 77.6%.

Oil at $0.339/litre and 70% seasonal efficiency could also compete with electricity.

For information on typical home space and water heating consumption and costs, I refer you to B.C. Hydro Data sheets H336, H337 and H310.

G.H. Pinch, P.Eng.
Heating & A/C Engineer, B.C. Hydro
Vancouver, B.C.

Data used in our chart was as published by Energy Mines & Resources Canada, and includes applicable taxes.

Oil heating costs will depend on the actual conversion efficiency. Our table of house space heating costs when using oil was based on an arbitrary seasonal efficiency, which in retrospect may have been overly optimistic.

Sir,

In the last two issues you refer to the $8,000 deterent and the slowness of producing results (Ontario Research Foundation Heat Recovery Ventilator testing), leading to the possible conclusion that not all HRV's out there are duds, to which I would like to submit this reply:

1. The new test standard was ready to run early in 1985.

2. The first test run for any manufacturer distributing (didn't even have to be Canadian or have a unit that was made here) a unit in Canada was subsidized so that the net cost to the manufacturer was only $2,800.

3. Tests for two units were completed in May and June of 1985, yet it took E.M.R. fully 6 months to release the results because they were still working on a reporting format.

4. Prior to the release of the first test results E.M.R. made available a second subsidization of testing to manufacturers. The basic reason for this second subsidy seems to have been that only two manufacturers were able to get their units through on the first go round.

5.Testing fees at O.R.F. are fully eligible for the Scientific Research Tax Credit. (100% recovery of expenses deducted from federal corporate income tax).

6. It is probable that some manufacturers have "passed" but do not wish to have the results released because the performance results are nothing to be proud of.

It can be seen from the above that it is neither expensive, nor has there been insufficient time for manufacturers to get their units tested or to make the necessary product changes and get the product tested a second time. If I were a consumer of HRV's I would be very sceptical of any manufacturer who has not completed the testing by now and cannot produce a page of official results. I for one am begining to get very sick and tired of hearing these kind of whining and whimpering excuses from some producers of HRV's.

The answer to your question then, from our point of view, is "if it doesn't have a test result sheet available, there's a very good chance that it IS A DUD".

It is true that the test requirements are not 'easy'. We feel however that the test requirements have resulted in our producing much better equipment than if we did not have to meet the test standard and that the ultimate beneficiary of the process will be the consumer of our equipment.

If however consumers such as the ones who read SOLPLAN REVIEW (who are, by and large the more sophisticated consumers) continue to accept excuses such as the ones that I have now twice read in SOLPLAN REVIEW, they deserve to reap the rewards of their actions. That is, inferior equipment that does not perform properly and for which there is no method to tell or to guess if it is performing anywhere near it's advertised rating. I repeat, consumers should be aware that there is little if not no excuse for a manufacturer of a viable piece of equipment not to have test results ready by now.

If you as a consumer wish to accept these excuses and continue to purchase equipment which does not have test results then you deserve what you are getting. Furthermore you may have the unfortunate

result of making sure that almost no-one gets a half decent piece of equipment because if it becomes possible for manufacturers to profit by not testing their equipment, then you will force other manufacturers to go back to producing inferior equipment in order to remain competitive. How about it? The choice is really yours!

Dara Bowser
Nortron Industries Ltd.
Air Changer Division

MARKETING IDEAS: WARRANTIES

Warranties provide an effective sales tool. They also provide further evidence to the buyer that the builder is confident of his expertise and quality, and is willing to stand behind his work.

The standard builder warranty covers the structure, materials and workmanship. A number of builders in the United States are now offering energy performance warranties - guaranteeing the performance of their houses. While it may seem like a rash idea, given the many ways a user can affect energy consumption, safeguards can be written into the guarantee (without making it meaningless). Such a warranty need not cost anything, but it can clinch a contract!

This is the text (slightly edited) of one interesting warranty that has been successful for Mad Dog Design and Construction Inc. in Tallahasse, Florida. With appropriate modification, it could be used by any low energy builder anywhere.

Subject to the following conditions, the builder hereby guarantees the buyer that the total billing for electricity and natural gas of the residence at ______ will not exceed an average of $50.per month, or a total of $600 for the first year of residence, ending ________.*

Should this total annual energy bill exceed $600, the builder agrees to directly reimburse the buyer for any excess over this amount. Further, should the total energy bill be less than $40 per month or $480 for the first year of use, then the contractor agrees to pay the buyer an Energy Conservation Bonus of $200. In order to be in full compliance with the guarantee, the buyer in turn agrees to do the following:*

1. Submit copies of utility bills to the contractor monthly.

2. Allow the contractor to conduct an energy audit and to install energy use monitoring equipment.

3. Fill out and return an energy useage questionnaire.

4. Use energy in a judicious manner, with a thermostat setting no less than 78°F in the summer, and no more than 74°F in the winter.

5. Allow the contractor to use and publish information about actual energy useage (we will be glad to without names if requested).

This guarantee applies only to the house as purchased. The addition of any extra significant conditioned space, electric additions or alterations, or non-compliance with any part of this agreement may void this guarantee.

** These figures are for households of up to 2 residents. Add $10 per month for each additional resident.*

The actual numbers will vary accoding to local conditions and energy prices, but the idea of a performance guarantee can be used anywhere.

By having the owner send in his monthly energy bill, the builder is ensuring the user is constantly keeping track of his energy bills. By making an offer to pay the owner a bonus if his energy bills are low, he is providing an incentive for the homeowner to keep consumption low.

We now have enough evidence that computer programs such as HOTCAN are accurate, so the likelyhood of having to pay out for excess energy consumption is small. Even if one house in 50 ends up costing the builder $100 or 200, the publicity value, goodwill and greater sales volume the guarantee offers should be well worth the trouble and more than cover the cost of an occasional payout.

Is the warranty effective? We are told that since introducing this warranty, Mad Dog Design & Construction went from a builder of half a dozen houses per year to several hundred per year!

MONITORING NOTES

Everyone is interested in performance results on low energy houses. R-2000 Program results indicate that actual energy consumption averaged across all sample houses was 104% of that predicted by computer calculation.

We have recently heard of several cases where energy bills came in at a much higher figure than that predicted by HOTCAN analysis.

Detailed evaluations and assesments are still going on, so we can't provide all details. However, a few observations are worth passing on.

One case is a single family house in the Vancouver area that has experienced high electric bills. The heating period included a 2 week spell of record-breaking cold weather (daily maximums did not go above -10°C), far below design minimum conditions (- 7°C in Vancouver).

The period covered was a time during which the HRV unit in the house froze up. Many units in the area are sold without defrosters. (Conditions in this climate zone do not warrant the extra expense of a defroster for 98% of the time.)

The prolonged cold spell, construction moisture contained in the building materials in the new house, and frozen HRV cores meant that the unit was pumping cold air directly into the house. No heat exchange could take place. At the time, the occupants were not aware that something was wrong. However, the heating system had to provide extra heating to overcome the cooling produced by the ventilation system.

Two other houses in the B.C. interior are being investigated for a similar reason. These houses even had heating loads in the shoulder season (April-May and Sept.-Oct.) when a low energy house can be expected to require no additional heat. The cooling effect of a mechanical ventilation system, which introduces a constant supply of fresh air is suspected as being a major cause for this extra heating. While the HRV's are recovering heat from the exhaust stream, it is never a 100% heat recovey, so the incoming air is always going to be cooler than that being vented out.

Occupant lifestyles are also a major determinant of energy consumption.

In low temperature radiant systems, controls set too high (or not responding efficiently to ambient conditions) will result in higher energy consumption. Residents will generally set the thermostat to a predetermined setting, not understanding that the air temperature (which is what a thermostat will measure) can be set lower for an equal comfort level.

Another occupant habit may be to be less concerned about operating the house efficiently, in the false belief that because the house is energy efficient, no further action is needed. It's the "I don't have to worry about closing the windows - it's a super insulated energy efficient house" syndrome.

Another case is an Ontario townhouse that uses electric space heating. The owners feel their electric bills are too high. Home features include spa type tubs. If the spa is used frequently, the energy use due to water consumption, along with other household appliances could contribute a major portion of the electrical consumption.

The homeowner will often not distinguish space heating from appliance use when it's on a single bill. Separate metering is being contemplated in this case to compare other household energy use compared to space heating requirements.

The number and age of the occupants can also be significant. The elderly generally need higher temperatures for comfort (22-23.5°C is not uncommon) while a young active family may be happy with 18-19.5°C.

We have also heard of another townhouse with high heating bills. An examination revealed that the neighbours on both sides went to Florida for the coldest part of each winter, leaving the units unoccupied but set at a low temperature. As a result, the year-round neighbour was paying for part of their heating bills!

Row housing design assumes that the common walls will be at the same temperature, so they do not contribute to the overall heating load.

These examples point to a need to consider a number of variables that may at first appear to be totaly irrelevant when monitoring potential problems.

BOOKS

Our building research and technology, as developed and implemented by the R-2000 Program, is world class. Do we have the courage to ensure that we take advantage and further it? Will we reap the benefits of our pioneering efforts? Or are we going to let an opportunity slip by?

Unless we see a continued determined committment to the R-2000 Program, on the part of all players in the housing industry - not just government but also builders and financial institutions, instead of playing safe, then we will loose our prominent position. Unless our building material manufacturers begin to actively promote good quality products and construction practices, we in time will begin to have to re-import our technology.

Sweden has made a very serious effort since the Second World War to upgrade its housing stock and building technology. In the past three decades they have developed factory methods and delivery systems that assure consistently high quality housing - from a factory floor, populated by a few highly skilled craftsmen operating sophisticated, flexible equipment to the building site, where a crew of four can put up a house in a single day.

A new book, Coming in from the Cold: Energy Wise Housing in Sweden explores how the North American housing industry might adapt the techniques which make Swedish housing comfortable, affordable, and virtually defect free.

The book is based on a two year study drawing on the findings of a group of researchers in the U.S. and Sweden.

The energy consumption of Swedish and American homes differ profoundly. Making allowances for climate and house size differences, Swedish homes run on less than 60% of the energy needs of an average Canadian home. In part this is due to the fact that unlike Canada and much of the industrial West, Sweden developed its energy-saving technology systematically. Energy efficiency is a by-product of a national housing policy developed with the full participation of the housing industry, that requires houses to be system designed to perform reliably.

As in North America, the building industry adds styling and amenities to help sell its products, but the Swedes will not sacrifice basic quality features to save costs or trade off sales features against function. Thus inexpensive houses may be smaller and have only basic facilities, but feature by feature they will perform as well as more expensive models.

In many ways, the markets in Sweden and North America are similar. In both areas, single family houses account for about two thirds of housing starts. New houses are only 15-20% smaller in Sweden. The level of affluence of propective buyers is roughly the same.

Similarities vanish when it comes to expectations of home buyers and the value they place on quality and comfort. In the 1970's, when the energy crisis hit and North Americans were responding by lowering thermostat settings or wearing more sweaters, Swedes were able to fine tune energy saving technology already in place and leave their thermostat settings alone.

This book has a decidedly U.S. bias, comparing the U.S. housing situation with Sweden. However, because of the similarity of the American housing scene to that in Canada, and the many references to other northern countries as well, many of the comparisons can be applied here.

This is a small volume that provides valuable reading about the direction in which building technology may be going. It should be required reading by anyone interested in the future of housing, or involved with policy making.

Coming in from the Cold: Energy Wise Housing in Sweden by Lee Schipper, Stephen Meyers, and Henry Kelly. 104pp with charts, illustrations and photos. $14.95

Available from The Drawing-Room Graphic Services Ltd. Box 86627, North Vancouver, B.C. V7L 2L4

LEBCO NEWS

THE NEED FOR CONTINUING SUPPORT FOR SECOND GENERATION R-2000 TECHNOLOGY

A new $18.8 million five year contract has been signed by Pat Carney, Minister of Energy Minaes & Resources with the Canadian Homebuilders Association for the continued delivery of the R-2000 program. The contract, however, is less than the $50 million that was being talked about.

If Canada is to gain the industrial benefits of R-2000 technology it is critical that the program not be cut back or strangled by budgetary trimming. The program has been tremendously useful in promoting low energy building in Canada. However, the program must not become stuck in a groove. Energy efficient building technology is evolving rapidly and the program must keep pace. More emphasis on promoting advanced, cost effective second-generation technology is needed.

The initial thrust of the R-2000 program has been on the promotion of first generation technology. Developed by the Priaire pioneers, first generation technology is typified by thick wall insulation, air-tight construction, and heat recovery ventilators. In contrast, second generation technology relies on technically more sophisticated factory produced building components to achieve the same dramatic energy savings at a lower capital cost.

Two key components are improved windows and advanced mechanical heat recovery systems. Conventional R-2000 technology adds about $5000 to the cost of a house, and this additional investment is paid back through energy savings in about 10 years. By contrast second generation technology has the potential to add less than $2500 to the cost of the house with a simple payback of only five years. These cost savings will not be realized immediately as the new products come on the market. However, in the same way that the cost of electronic calculators has dropped significantly as the market developed and technology was refined, the predicted cost savings will be achieved because the new technology is much less material and labour intensive.

EMR has invested much money in the support of first generation R-2000 technology. However, as with other technologies, the long term market will be for more refined, second and third generation products. This is where the major profits will be realized. Canada's investment in first generation technology will be wasted unless the second generation market is vigorously pursued.

As with ice hockey, Canadian manufacturer's should be internationally competitive in low energy building technology. Because of our cold climate, Canada is the early world market for the advanced technology. Through experience with domestic production, Canadian companies will be in a strong position to export low energy building products, notably to the United States, a potential multi-billion dollar market.

Because the home building industry is fragmented, the introduction of new technology is a very slow process. The technical merits of a new product have to be demonstrated to builders and designers in all regions of the country. There are also significant regulatory hurdles relating to building code and product approval. For first generation technology, the R-2000 Program has played a key role in accelerating the acceptance of the new energy conserving technology. A continued support program is required for second generation technology.

The government must remember that the real engine of growth for the rest of the decade and into the 1990's is clever technology, not resource depletion. Further cutbacks to the R-2000 program will throw away the potential of large industrial benefits of the new technologies possible. We are already begining to import products from Sweden or the US rather than developing and manufacturing our own.

PRODUCT SHOWCASE

LEBCO is organizing a product showcase as part of this year's SESCI conference in Winnipeg (June 23-26, 1986). This will allow manufacturers to present new products to the leading designers and builders of low energy housing in Canada.

At the showcase, the manufacturer is centre stage with an attentive audience. He will have an opportunity to describe

his product to those present. There will be time for questions and answers or a general discussion about the product/service.

A LEBCO technical panel will review products to be showcased. For acceptance the product must be new and innovative, and be of interest to builders and designers of low energy houses. The 'product' can be hardware, unusual commercial services or software packages.

If you would like to make a presentation or know of a product or service that should be, contact: Bill Eggertson, LEBCO, Suite 206 - 135 York St. Ottawa, Ont. K1N 5T4 or phone 613-236-4594. As an alternative, forward any enquiries to SOLPLAN REVIEW.

NEXT ISSUE

* How to balance ventilation systems.
* Safe and efficient fireplaces for low energy houses.
* Plus more about new products, news and more.

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The first technical meeting of LEBCO will be held in conjunction with the SESCI annual conference in Winnipeg, June 23-26, 1986.

Some sessions of interest will include:

*Indoor air quality

*Heat Recovery (SEBH demonstration program, heating & ventilation systems)

*Low Energy Buildings (monitoring results, air tightness issues, simulations)

*Passive solar (passive/hybrid solar techniques to meet R-2000 standards)

*Simulation and monitoring (evaluation of HOTCAN 3.0, programs for evaluation of retrofits)

*Energy Conservation and Retrofits (basement heat losses, super windows)

The <u>LEBCO SYMPOSIUM: An Update on Low Energy Building Activities</u> Scheduled speakers include: Harold Orr, Ike Warkentin, Mark Riley, Greg Allen, Sam Cryer, Gary Proskiw, Steve Carpenter

Registration fees: $145 for SESCI/LEBCO members; $175 for non-members

For a registration kit, contact: Renewable Energy Conference '86, Box 1256, Winnipeg, Man. R3C 2Y4

Clarification:

In the last issue of SOLPLAN REVIEW we discussed R-2000 Program technical standards revisions. In the discussion of the ventilation criteria, (the requirement for exhaust air capacity of 50 cfm from bathrooms, 100 cfm from the kitchen), some readers were left with the impression that these are new National Building Code criteria. This is a requirement of the proposed new technical requirements of the R-2000 Program only.

The National Building Code only calls for a mechanical ventilation system capable of providing one half air change per hour.

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